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NABL - Accredited Laboratory as per ISO / IEC-17025 : 2005

JAS-ANZ BSCIC ISO 9001 REGISTERED

Job No.: CTCE/BBMP/W.No.11/KRIDL/WMM/Gradation/2016-17 : 25.08.2016

GRADATION FOR WMM
MORTH TABLE-400-11

Customer : **Asst. Executive Engineer,** Vidyaranyapura Sub Division, BBMP, Bangalore.

Agency : **Executive Engineer,** KRIDL, Bangalore.

Name of Work : Development and improvements to roads and drains in main road and cross roads in Ward No.11, Kuvempunagara, Vidyaranyapura Sub Division, BBMP, Bangalore.

Reference : BBMP/EE/BTP/WO/76/2016-17 Dated: 20.07.2016

Date of Testing : 25.08.2016

Material : WMM

Sample Location : WMM Mix Plant Oven Dry Wt (gm): **5000**

Is Sieve Size in mm	Weight Retained (gm)	Cumulative Weight Retained (gm)	Cumulative % of Retained	Cumulative % of Passing	Spec.Limits
53	0	0	0	100	100
45	155	155	3.1	96.9	95-100
22.4	1525	1680	33.6	66.4	60-80
11.2	985	2665	53.3	46.7	40-60
4.75	900	3565	71.3	28.7	25-40
2.36	650	4215	84.3	15.7	15-30
0.600	320	4535	90.7	9.3	8-22
0.075	300	4835	96.7	3.3	0-8

Note:

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AE-11

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Basaveshwaranagar, Bangalore-560 079.

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T-2377

Job No.: CTCE/BBMP/W.No.11/KRIDL/CSR-08/107h/QB(BM)/2016-17 13.09.2016

TEST REPORT ON DETERMINATION OF BITUMEN CHARACTERISTICS

*CUSTOMER	:	**Asst. Executive Engineer**, Vidyaranyapura Sub Division, BBMP, Bangalore.
*AGENCY	:	**Executive Engineer,** KRIDL, Bangalore.
*NAME OF THE WORK	:	Development and improvements to roads and drains in main road and cross roads in Ward No.11, Kuvempunagara, Vidyaranyapura Sub Division, BBMP, Bangalore.
REFERENCE	:	BBMP/EE/BTP/WO/76/2016-17 Dated: 20.07.2016
*SAMPLE ID	:	Bitumen
DATE OF SAMPLING	:	12.09.2016
DARE OF TESTING	:	13.09.2016

The results of the tests conducted on the bitumen sample.

Sl. No	Description	Test Method as per IS	Test Result	Requirement as per IS:73:2013
1	Penetration at 25 °C, 1/10 mm	IS :1203 -1978 (RA-2009)	88	80 to 100
2	Softening point, °C	IS :1205 -1978 (RA-2009)	45	Min. 40
3	Ductility at 27°C, cm	IS :1208 -1978 (RA-2009)	100 >	Min. 75
4	Flash Point, °C	IS :1209 -1978 (RA-2009)	298	Min. 220

*Information is furnished by the Customer/Representative.

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VISHWANATH. I.A.
Chief Executive Officer

AEE (VRP) SD

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Job No: CTCE/BBMP/W.No.11/KRIDL/BM/AIV/2016-17 13.09.2016

Aggregate Impact Value

IS: 2386 Part IV

Customer	**Asst. Executive Engineer,** Vidyaranyapura Sub Division, BBMP, Bangalore.
Agency	**Executive Engineer,** KRIDL, Bangalore.
Name of the Work	Development and improvements to roads and drains in main road and cross roads in Ward No.11, Kuvempunagara, Vidyaranyapura Sub Division, BBMP, Bangalore.
Reference	BBMP/EE/BTP/WO/76/2016-17 Dated: 20.07.2016
Source / Location	Hotmix Plant, Bangalore
Type of Mix	Bituminous Macadam
Date of Testing	13.09.2016

Sl No.	Details	Trial No. 1	Trial No. 2	Average
1	Total weight of aggregate sample filling the cylindrical measure = W_1 g	385	386	
2	Weight of agregate passing 2.36 mm sieve after the test = W_2 g	80	81	
3	Weight of aggregate retained 2.36 mm sieve after the test = W_3 g	305	305	
4	Aggregate Impact value = percent fines	20.78	20.98	
	$100^* (W_2/W_1)\%$			20.88

Comments:

→ Maximum allowable Aggregate Impact value for Bituminous Macadam is 30%

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Job No: CTCE/BBMP/W.No.11/KRIDL/BM/Shape.T/2016-17 : 13.09.2016

DETERMINATION OF FLAKINESS INDEX & ELONGATION INDEX OF COARSE AGGREGATES

Customer	: **Asst. Executive Engineer,** Vidyaranyapura Sub Division, BBMP, Bangalore.
Agency	: **Executive Engineer,** KRIDL, Bangalore.
Name of Work	: Development and improvements to roads and drains in main road and cross roads in Ward No.11, Kuvempunagara, Vidyaranyapura Sub Division, BBMP, Bangalore.
Reference	: BBMP/EE/BTP/WO/76/2016-17 Dated: 20.07.2016
Technical Reference	: IS 2386(Part 1) 1963 (RA 2011)
Type of Mix	: Bituminious Macadum
Date of Testing	: 13.09.2016

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Flakiness Index = **11.03%**

Elongation Index = **13.25%**

Result : Combined Flakiness & Elongation index **24.28%**

Comments:

→ Maximum allowable Flakiness & Elongation Index for Bituminous Macadam is 30%

Note:

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Job No: CTCE/BBMP/W.No.11/KRIDL/BM/Stripping/2016-17 14.09.2016

Stripping Value of Road Aggregates (Static Immersion Test)

IS: 6241

Customer	**Asst. Executive Engineer,** Vidyaranyapura Sub Division, BBMP, Bangalore.
Agency	**Executive Engineer,** KRIDL, Bangalore.
Name of the work	Development and improvements to roads and drains in main road and cross roads in Ward No.11, Kuvempunagara, Vidyaranyapura Sub Division, BBMP, Bangalore.
Reference	BBMP/EE/BTP/WO/76/2016-17 Dated: 20.07.2016
Type of Mix	Bituminous Macadam
Date of Testing	14.09.2016

Type of binder : 80/100
Percentage of binder used : 5.0% by wt.
Total weight of aggregate : 200 g
Total weight of binder : 10.0 g
Temperature of water-bath : 40° C

Observation Number	Stripping, Percentage	Average, Percentage	Average Retained Coating, %
1	3.2	3.30	96.70
2	3.3		
3	3.4		

Comments:

→ Minimum allowable Aggregate retained coating for Bituminous Macadam is 95%

Note:

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Job No: CTCE/BBMP/W.No.11/KRIDL/BM/Sp_Wa/2016-17

14.09.2016

Specific Gravity And Water Absorption Test

IS: 2386 Part III

Customer	**Asst. Executive Engineer,** Vidyaranyapura Sub Division, BBMP, Bangalore.
Agency	**Executive Engineer,** KRIDL, Bangalore.
Name of the Work	Development and improvements to roads and drains in main road and cross roads in Ward No.11, Kuvempunagara, Vidyaranyapura Sub Division, BBMP, Bangalore.
Reference	BBMP/EE/BTP/WO/76/2016-17 Dated: 20.07.2016
Source / Location	Hotmix Plant, Bangalore.
Type of Mix	Bituminous Macadam
Date of Testing	14.09.2016

Sl. No.	Details	Notation	Test Number			Mean Value
			Test 1	Test 2	Test 2	
1	Weight of aggregate suspended in water with the basket	W_1 g	2011	2012	2013	
2	Weight of basket suspended in water	W_2 g	750	750	750	
3	Weight of saturated aggregate in water	$(W_1 - W_2) = W_s$ g	1261	1262	1263	
4	Weight of saturated surface dry aggregate in air	W_3 g	2010	2020	2025	
5	Weight of water equal to the volume of the aggregate	$(W_3 - W_S)$ g	749	758	762	
6	Weight of oven dried aggregate	W_4 g	2000	2003	2010	
7	Specific Gravity	$W_4/(W_3-W_S)$	2.670	2.642	2.638	2.654
8	Apparent Specific gravity	$W_4/(W_4-W_S)$	2.706	2.703	2.691	2.699
9	Water Absorption	$((W_3-W_4)*100)/W_4$	0.50%	0.85%	0.75%	0.62%

Comments:

→ Maximum allowable Aggregate Water absorption value for Bituminous Macadam is 2.0%

Note:

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Job No: CTCE/BBMP/W.No.11/KRIDL/BM/Agg.G/2016-17 14.09.2016

Aggregate Gradation Test

IS : 2386 Part I

Customer	**Asst. Executive Engineer,** Vidyaranyapura Sub Division, BBMP, Bangalore.
Agency	**Executive Engineer,** KRIDL, Bangalore.
Name of the work	Development and improvements to roads and drains in main road and cross roads in Ward No.11, Kuvempunagara, Vidyaranyapura Sub Division, BBMP, Bangalore.
Reference	BBMP/EE/BTP/WO/76/2016-17 Dated: 20.07.2016
Sample ID	Hotmix Plant, Bangalore.
Type of Mix	Bituminous Macadam
Date of Testing	14.09.2016

Total Weight of Sample: 5100 gm

SIEVE SIZE, mm	Weight Retained, gm	% Retained	Cummulative % Retained	% Passing	Grade-II As per MORTH	Remarks
26.5	0	0	0	100	100	Gradation satisfies Grade-II MORTH specification
19	355	6.96	6.96	93.04	90-100	
13.2	1595	31.27	38.24	61.76	56-88	
4.75	1490	29.22	67.45	32.55	16-36	
2.36	950	18.63	86.08	13.92	4-19	
0.3	390	7.65	93.73	6.27	2-10	
0.075	165	3.24	96.96	3.04	0-8	

Total Weight of Sample: 5200 gm

SIEVE SIZE, mm	Weight Retained, gm	% Retained	Cummulative % Retained	% Passing	Grade-II As per MORTH	Remarks
26.5	0	0	0	100	100	Gradation satisfies Grade-II MORTH specification
19	315	6.06	6.06	93.94	90-100	
13.2	1655	31.83	37.88	62.12	56-88	
4.75	1480	28.46	66.35	33.65	16-36	
2.36	825	15.87	82.21	17.79	4-19	
0.3	450	8.65	90.87	9.13	2-10	
0.075	170	3.27	94.13	5.87	0-8	

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Job No.: CTCE/BBMP/W.No.11/KRIDL/CSR-08/107h/QB(BC)/2016-17 14.09.2016

TEST REPORT ON DETERMINATION OF BITUMEN CHARACTERISTICS

*CUSTOMER	:	**Asst. Executive Engineer**, Vidyaranyapura Sub Division, BBMP, Bangalore.
*AGENCY	:	**Executive Engineer,** KRIDL, Bangalore.
*NAME OF THE WORK	:	Development and improvements to roads and drains in main road and cross roads in Ward No.11, Kuvempunagara, Vidyaranyapura Sub Division, BBMP, Bangalore.
REFERENCE	:	BBMP/EE/BTP/WO/76/2016-17 Dated: 20.07.2016
*SAMPLE ID	:	Bitumen
DATE OF SAMPLING	:	12.09.2016
DATE OF TESTING	:	14.09.2016

The results of the tests conducted on the bitumen sample.

Sl. No	Description	Test Method as per IS	Test Result	Requirement as per IS:73:2013
1	Penetration at 25 ^{0}C, 1/10 mm	IS :1203 -1978 (RA-2009)	82	80 to 100
2	Softening point, ^{0}C	IS :1205 -1978 (RA-2009)	44	Min. 40
3	Ductility at 27^{0}C, cm	IS :1208 -1978 (RA-2009)	100 >	Min. 75
4	Flash Point, ^{0}C	IS :1209 -1978 (RA-2009)	294	Min. 220

*Information is furnished by the Customer/Representative.

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Chief Executive Officer

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Job No.: CTCE/BBMP/W.No.11/KRIDL/BC/AIV/2016-17 14.09.2016

Aggregate Impact Value

IS: 2386 Part IV

Customer	**Asst. Executive Engineer,** Vidyaranyapura Sub Division, BBMP, Bangalore.
Agency	**Executive Engineer,** KRIDL, Bangalore.
Name of the Work	Development and improvements to roads and drains in main road and cross roads in Ward No.11, Kuvempunagara, Vidyaranyapura Sub Division, BBMP, Bangalore.
Reference	BBMP/EE/BTP/WO/76/2016-17 Dated: 20.07.2016
Source / Location	Hot Mix Plant, Bangalore
Type of Mix	Bituminous Concrete
Date of Testing	14.09.2016

Sl No.	Details	Trial No.		Average
		1	2	
1	Total weight of aggregate sample filling the cylindrical measure = W_1 g	380	381	
2	Weight of agregate passing 2.36 mm sieve after the test = W_2 g	80	81	
3	Weight of aggregate retained 2.36 mm sieve after the test = W_3 g	300	300	
4	Aggregate Impact value = percent fines 100* (W_2/W_1) percent	21.05	21.26	21.16

Comments:

→ Maximum allowable Aggregate Impact value for Bituminous Concrete is 24%

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Job No.: CTCE/BBMP/W.No.11/KRIDL/BC/Shape.T/2016-17 : 14.09.2016

DETERMINATION OF FLAKINESS INDEX & ELONGATION INDEX OF COARSE AGGREGATES

Customer	: **Asst. Executive Engineer,** Vidyaranyapura Sub Division, BBMP, Bangalore.
Agency	: **Executive Engineer,** KRIDL, Bangalore.
Name of Work	: Development and improvements to roads and drains in main road and cross roads in Ward No.11, Kuvempunagara, Vidyaranyapura Sub Division, BBMP, Bangalore.
Reference	: BBMP/EE/BTP/WO/76/2016-17 Dated: 20.07.2016
Technical Reference	: IS 2386(Part 1) 1963 (RA 2007)
Type of Mix	: Bituminous Concrete
Date of Testing	: 14.09.2016

Result : Flakiness Index = **12.90%**

Elongation Index = **13.60%**

Result : Combined Flakiness & Elongation index **26.50%**

Comments:

→ Maximum allowable Flakiness & Elongation Index for Bituminous Concrete is 30%

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Job No.: CTCE/BBMP/W.No.11/KRIDL/BC/Stripping/2016-17 15.09.2016

Stripping Value of Road Aggregates (Static Immersion Test)

IS: 6241

Customer	**Asst. Executive Engineer,** Vidyaranyapura Sub Division, BBMP, Bangalore.
Agency	**Executive Engineer,** KRIDL, Bangalore.
Name of the Work	Development and improvements to roads and drains in main road and cross roads in Ward No.11, Kuvempunagara, Vidyaranyapura Sub Division, BBMP, Bangalore.
Reference	BBMP/EE/BTP/WO/76/2016-17 Dated: 20.07.2016
Type of Mix	Bituminous Concrete
Date of Testing	15.09.2016

Type of binder : 80/100

Percentage of binder used : 5.00% by wt.

Total weight of aggregate : 200 g

Total weight of binder : 10.00 g

Temperature of water-bath : 40° C

Observation Number	Stripping, Percentage	Average, Percentage	Average Retained Coating, %
1	3.1		
2	3.3	3.20	96.80
3	3.2		

Comments:

→ Minimum allowable Aggregate retained coating for Bituminous Concrete is 95%

Note:

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Job No.: CTCE/BBMP/W.No.11/KRIDL/BC/Sp_Wa/2016-17 15.09.2016

Specific Gravity And Water Absorption Test

IS: 2386 Part III

Customer	**Asst. Executive Engineer,** Vidyaranyapura Sub Division, BBMP, Bangalore.
Agency	**Executive Engineer,** KRIDL, Bangalore.
Name of the Work	Development and improvements to roads and drains in main road and cross roads in Ward No.11, Kuvempunagara, Vidyaranyapura Sub Division, BBMP, Bangalore.
Reference	BBMP/EE/BTP/WO/76/2016-17 Dated: 20.07.2016
Type of Mix	Bituminous Concrete
Date of Testing	15.09.2016

Sl. No.	Details	Notation	Test Number			Mean Value
			Test 1	Test 2	Test 3	
1	Weight of aggregate suspended in water with the basket	W_1 g	2012	2013	2014	
2	Weight of basket suspended in water	W_2 g	755	755	755	
3	Weight of saturated aggregate in water	$(W_1 - W_2) = W_S$ g	1239	1238	1259	
4	Weight of saturated surface dry aggregate in air	W_3 g	2021	2022	2024	
5	Weight of water equal to the volume of the aggregate	$(W_3 - W_S)$ g	782	784	765	
6	Weight of oven dried aggregate	W_4 g	2006	2008	2005	
7	Specific Gravity	$W_4/(W_3-W_S)$	2.565	2.561	2.621	2.582
8	Apparent Specific gravity	$W_4/(W_4-W_S)$	2.615	2.608	2.688	2.637
9	Water Absorption	$((W_3-W_4)*100)/W_4$	0.75%	0.70%	0.95%	0.80%

Comments:

→ Maximum allowable Aggregate Water absorption value for Bituminous Concrete is 2.0%

Note:

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Job No.: CTCE/BBMP/W.No.11/KRIDL/BC/Agg/2016-17 15.09.2016

Aggregate Gradation Test

IS : 2386 Part I

Customer	**Asst. Executive Engineer,** Vidyaranyapura Sub Division, BBMP, Bangalore.
Agency	**Executive Engineer,** KRIDL, Bangalore.
Name of theWork	Development and improvements to roads and drains in main road and cross roads in Ward No.11, Kuvempunagara, Vidyaranyapura Sub Division, BBMP, Bangalore.
Reference	BBMP/EE/BTP/WO/76/2016-17 Dated: 20.07.2016
Sample I / D	Hot Mix Plant, Bangalore
Type of Mix	Bituminous Concrete
Date of Testing	15.09.2016

Total Weight of Sample: **5150** gm

SIEVE SIZE, mm	Weight Retained, gm	% Retained	Cummulative % Retained	% Passing	JOBMIX Gradation as per MORTH	Remarks
19	0	0	0	100	100	Gradation satisfies Bituminous concrete Grade-II specification as per MORTH
13.2	625	12.14	12.14	87.86	79 - 100	
9.5	455	8.83	20.97	79.03	70 - 88	
4.75	595	11.55	32.52	67.48	53 - 71	
2.36	535	10.39	42.91	57.09	42 - 58	
1.18	640	12.43	55.34	44.66	34 - 48	
0.600	560	10.87	66.21	33.79	26 - 38	
0.300	590	11.46	77.67	22.33	18 - 28	
0.150	355	6.89	84.56	15.44	12 - 20	
0.075	395	7.67	92.23	7.77	4 - 10	

Total Weight of Sample: **5250** gm

SIEVE SIZE, mm	Weight Retained, gm	% Retained	Cummulative % Retained	% Passing	JOBMIX Gradation as per MORTH	Remarks
19	0	0	0	100	100	Gradation satisfies Bituminous concrete Grade-II specification as per MORTH
13.2	635	12.10	12.10	87.90	79 - 100	
9.5	475	9.05	21.14	78.86	70 - 88	
4.75	580	11.05	32.19	67.81	53 - 71	
2.36	635	12.10	44.29	55.71	42 - 58	
1.18	645	12.29	56.57	43.43	34 - 48	
0.600	605	11.52	68.10	31.90	26 - 38	
0.300	625	11.90	80.00	20.00	18 - 28	
0.150	315	6.00	86.00	14.00	12 - 20	
0.075	415	7.90	93.90	6.10	4 - 10	

AE-11

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Note:

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⇒ The results indicated above are based on the tests carried out on the samples received in the laboratory.

⇒ Any Query regarding the report must be reported within 30 days from the date of testing.

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CIVIL-TECH CONSULTANTS AND ENGINEERS

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Job No.: CTCE/BBMP/W.No.11/KRIDL /BC/Stability/2016-17 15.09.2016

TEST REPORT ON STABILITY OF MIX

Customer	:	**Asst. Executive Engineer**, Vidyaranyapura Sub Division, BBMP, Bangalore.
Agency	:	**Executive Engineer,** KRIDL, Bangalore.
Name of Work	:	Development and improvements to roads and drains in main road and cross roads in Ward No.11, Kuvempunagara, Vidyaranyapura Sub Division, BBMP, Bangalore.
Reference	:	BBMP/EE/BTP/WO/76/2016-17 Dated: 20.07.2016
Source of location	:	Hot mix Plant, Bangalore
Type of Mix	:	Bituminous Concrete
Date of Testing	:	15.09.2016

The results of the tests conducted on the bituminous concrete mix sample are as follows:

Sl. No	Description	Test Result 1	Test Result 2	Requirement as per MORTH (Table 500-19)
1	Marshal Stability, Kn	9.10	9.15	9 Kn (min)
2	Marshal flow, mm	2.80	3.10	2 – 4
3	Percent air voids in Mineral Aggregate	13.15	13.30	3 - 6
4	Voids in Compacted Mix	3.20	4.05	13 – 15
5	Percent Voids filled with Bitumen	66.20	67.25	65 - 75
6	Density, g/cc	2.26	2.27	--

Note:

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